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EXAMINER
SONG, MATTHEW J

ART UNIT	PAPER NUMBER
1765	

DATE MAILED: 03/18/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/835,498	OH ET AL.	
	Examiner	Art Unit	
	Matthew J Song	1765	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *15 December 2003*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-11* is/are pending in the application.

4a) Of the above claim(s) *5-11* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-4* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *12/15/2003*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Election/Restrictions

1. This application contains claims 5-11 drawn to an invention nonelected with traverse in the paper filed on 4/4/2002. A complete reply to the final rejection must include cancellation of nonelected claims or other appropriate action (37 CFR 1.144) See MPEP § 821.01.

Claim Rejections - 35 USC § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

3. Claims 1, 3 and 4 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sivaramakrishnan et al (US 5,879,574) in view of Nishizawa et al (US 6,464,793), Tsuchimoto (US 3,916,034) and Powell et al (US 6,287,643).

Sivaramakrishnan et al discloses a Chemical vapor deposition (CVD) apparatus includes a susceptor **25** installed inside the reactive chamber, a heater/lift assembly **30** and a remote microwave plasma system **55** to deposit plasma enhanced CVD films by inputting deposition reactive gases into system **55** via input line **57** (col 14, ln 20-25). Sivaramakrishnan et al also discloses for plasma processes the CVD apparatus will include a gas feed-through box housing gas passages **83**, **85** to enable the application of high voltage RF power to the gas box (col 26, ln 40-45). Sivaramakrishnan et al also discloses a vacuum pump is activated to generate vacuum pressure within a pumping channel, thereby drawing the process gases and plasma residue out of the processing chamber through a exhaust port **361** (col 35, ln 33-37 and Fig 4 and 8), where the exhaust port reads on applicant's gas outlet. Sivaramakrishnan et al also discloses a process selector subroutine **153** identifies the desired set of process parameters needed to operate the process chamber, where the process parameters include process gas composition and flow rates, temperature, pressure, plasma composition and chamber wall temperature (Fig 1D and col 17, ln 20-35). Sivaramakrishnan et al discloses a process gas control subroutine **163** for controlling the process gas composition and flow rates, which reads on applicant's gas supply controller (col 18, ln 50-67) and heat control subroutine **167** for controlling the temperature (col 19, ln 58-67), which reads on applicant's temperature controller. Sivaramakrishnan et al also teaches a chamber with a ceiling (Fig 1A).

Sivaramakrishnan et al does not disclose at least two gas supply controllers respectively installed at the gas supply pipes to supply the material gases alternately into the chamber.

In a semiconductor crystal growth apparatus, note entire reference, Nishizawa et al teaches a vessel **1** includes nozzles **4** and **5** for introducing gaseous compounds, where the

nozzles **4** and **5** are provided with on-off valves **6** and **7** for controlling the introduced amounts of gaseous compounds. Nishizawa et al also teaches a control unit **18** controls the opening and closing of the valves **6** and **7** for alternately and repeatedly introducing gases (col 4-5 and Fig 3). It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify Sivaramakrishnan et al with Nishizawa et al to grow an epitaxial layer having a desired thickness can be attained with precision as precise as a single molecular layer (col 4, ln 60-67) and to prevent undesired reactions between two or more source gases.

The combination of Sivaramakrishnan et al and Nishizawa et al does not disclose at least two remote plasma generators installed outside the reactive chamber.

In a method of transporting plasma to a substrate to grow a single crystal of material on a substrate, note entire reference, Tsuchimoto teaches two or more selected materials are turned into separate ionized plasmas in separate plasma generating chambers **1a** and **1b** (Abstract and Embodiment 2). It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of Sivaramakrishnan et al and Nishizawa et al with Tsuchimoto because a plurality of materials, which cannot coexist in a single plasma generator, can be separately turned into the corresponding plasma (col 9, ln 1-67).

The combination of Sivaramakrishnan et al, Nishizawa et al, and Tsuchimoto does not teach one of the gas supply pipes surrounds another of the gas supply pipes, the gas supply pipes penetrate the ceiling of the reactive chamber to be extended to a position above the susceptor.

In an apparatus for injecting atomic species in a plasma reactor, note entire reference, Powell et al teaches a coaxial injector tube comprising an outer tube **72** and an inner tube **84** used for importing gas to a chamber (col 7, ln 55 to col 8, ln 67). Powell et al also teaches the gas

tubes penetrate the ceiling of a chamber **86** through a common inlet so as to extend to a position above a susceptor **92** (Fig 5). It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of Sivaramakrishnan et al, Nishizawa et al, and Tsuchimoto with Powell's injector tube because concurrent injection increases uniformity of distribution of reactant gas species at a wafers surface (col 8, ln 3-15).

Referring to claim 1, the combination of Sivaramakrishnan et al, Nishizawa et al, Powell et al and Tsuchimoto does not teach the plasma generators are for alternatively activating the material gases supplied through the gas supply pipes in a manner enabling operation without requiring temperature stabilization times by minimizing absorption of a reactive gas and a temperature sensitivity of a chemical reaction when materials comprising plural different components are to be deposited as the film. This feature is an intended use of the two remote plasma generators installed outside the reactive chamber and respectively connected to the gas supply pipes and the two remote plasma generators are taught by the combination of Sivaramakrishnan et al, Nishizawa et al, Powell et al and Tsuchimoto. A recitation of the intended use of the claimed invention must result in a structural difference between the claimed invention and the prior art in order to patentably distinguish the claimed invention from the prior art. If the prior art structure is capable of performing the intended use, then it meets the claim. See *In re Casey*, 152 USPQ 235 (CCPA 1967) and *In re Otto*, 136 USPQ 458, 459 (CCPA 1963). The combination of Sivaramakrishnan et al, Nishizawa et al, Powell et al and Tsuchimoto teaches the structure claimed by applicant, which would be capable of performing the claimed intended use. Also, the combination of Sivaramakrishnan et al, Nishizawa et al, Powell et al and Tsuchimoto does not teach the apparatus is an atomic layer deposition apparatus. This limitation

is also an intended use of the apparatus. The combination of Sivaramakrishnan et al, Nishizawa et al, Powell et al and Tsuchimoto teaches all of the structural limitations of claim 1, as discussed previously, therefore the apparatus taught by the combination of Sivaramakrishnan et al, Nishizawa et al, Powell et al and Tsuchimoto would be capable of operating as an atomic layer deposition apparatus.

Referring to claim 3, the combination of Sivaramakrishnan et al, Nishizawa et al, Powell et al and Tsuchimoto teaches a heater/lift assembly **30**.

Referring to claim 4 the combination of Sivaramakrishnan et al, Nishizawa et al, Powell et al and Tsuchimoto teaches a vacuum pump attached an exhaust port.

4. Claims 1, 3 and 4 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sivaramakrishnan et al (US 5,879,574) in view of Nishizawa et al (US 6,464,793), Tsuchimoto (US 3,916,034) and Schmitt et al (US 5,356,672).

The combination of Sivaramakrishnan et al, Nishizawa et al, and Tsuchimoto teach all of the limitations of claim 1, as discussed previously, except the combination of Sivaramakrishnan et al, Nishizawa et al, and Tsuchimoto does not teach one of the gas supply pipes surrounds another of the gas supply pipes, the gas supply pipes penetrate the ceiling of the reactive chamber to be extended to a position above the susceptor.

In a method of depositing a thin film, note entire reference, Schmitt et al teaches a gas jet apparatus **14** configured on a port **16** of a wall of a vacuum chamber **12** and the apparatus is comprised of a preferably cylindrical large nozzle **19** with an interior cavity **20**, which receives gas from a reservoir **22**. Schmitt et al also teaches a small nozzle **30** is coaxial with the gas jet

apparatus receives gas from a reservoir **34** (col 3, ln 60 to col 4, ln 67). Schmitt et al also teaches the gas supply pipes being arranged to penetrate the ceiling **18** of the chamber **12** through a common inlet **16** so as to extend to a position above a susceptor **44** (Fig 1). It would have been obvious to a person of ordinary skill in the art at the time of the invention the combination of Sivaramakrishnan et al, Nishizawa et al, and Tsuchimoto with Schmitt et al's gas jet apparatus because concurrent injection increases uniformity of distribution of reactant gas species at a wafers surface.

Referring to claim 1, the combination of Sivaramakrishnan et al, Nishizawa et al, Schmitt et al and Tsuchimoto does not teach the plasma generators are for alternatively activating the material gases supplied through the gas supply pipes in a manner enabling operation without requiring temperature stabilization times by minimizing absorption of a reactive gas and a temperature sensitivity of a chemical reaction when materials comprising plural different components are to be deposited as the film. This feature is an intended use of the two remote plasma generators installed outside the reactive chamber and respectively connected to the gas supply pipes and the two remote plasma generators are taught by the combination of Sivaramakrishnan et al, Nishizawa et al, Schmitt et al and Tsuchimoto. A recitation of the intended use of the claimed invention must result in a structural difference between the claimed invention and the prior art in order to patentably distinguish the claimed invention from the prior art. If the prior art structure is capable of performing the intended use, then it meets the claim. See *In re Casey*, 152 USPQ 235 (CCPA 1967) and *In re Otto*, 136 USPQ 458, 459 (CCPA 1963). The combination of Sivaramakrishnan et al, Nishizawa et al, Schmitt et al and Tsuchimoto teaches the structure claimed by applicant, which would be capable of performing

the claimed intended use. Also, the combination of Sivaramakrishnan et al, Nishizawa et al, Schmitt et al and Tsuchimoto does not teach the apparatus is an atomic layer deposition apparatus. This limitation is also an intended use of the apparatus. The combination of Sivaramakrishnan et al, Nishizawa et al, Schmitt et al and Tsuchimoto teaches all of the structural limitations of claim 1, as discussed previously, therefore the apparatus taught by the combination of Sivaramakrishnan et al, Nishizawa et al, Schmitt et al and Tsuchimoto would be capable of operating as an atomic layer deposition apparatus.

5. Claim 2 is rejected under 35 U.S.C. 103(a) as being unpatentable over Sivaramakrishnan et al (US 5,879,574) in view of Nishizawa et al (US 6,464,793), Tsuchimoto (US 3,916,034) and Powell et al (US 6,287,643) or Sivaramakrishnan et al (US 5,879,574) in view of Nishizawa et al (US 6,464,793), Tsuchimoto (US 3,916,034) and Schmitt et al (US 5,356,672) as applied to claim 1 above, and further in view of Amano et al (US 5,948,485).

The combination of Sivaramakrishnan et al, Nishizawa et al, Powell et al and Tsuchimoto or the combination of Sivaramakrishnan et al, Nishizawa et al, Tsuchimoto and Schmitt et al teaches all of the limitations of claim 2, except a grounding unit connected to the upper container and lower container to clean the inside of the chamber and a RF power generator connected to the susceptor to apply an RF power to the susceptor.

In an apparatus for plasma deposition, Amano et al teaches a plasma process apparatus includes a container **2** divided into two parts, a plasma chamber **21** and a reaction chamber **22**, where the vacuum container **2** is grounded at zero potential. Amano et al also teaches aluminum stage **52** for use as a susceptor and the stage is connected with a radio-frequency power supply

unit **61** for plasma lead-in through a blocking capacitor. It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of Sivaramakrishnan et al, Nishizawa et al, Powell et al and Tsuchimoto or the combination of Sivaramakrishnan et al, Nishizawa et al, Tsuchimoto and Schmitt et al with Amano's susceptor connected with a radio-frequency power supply because ions are confined to the target object on the susceptor (col 5, ln 1-10). Also it would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of Sivaramakrishnan et al, Nishizawa et al, Powell et al and Tsuchimoto or the combination of Sivaramakrishnan et al, Nishizawa et al, Tsuchimoto and Schmitt et al with Amano's grounded container because it protects the integrity of the chamber and the chamber circuitry from any static discharge or induced electrical currents that may build in or on the chamber.

Response to Arguments

6. Applicant's arguments with respect to claims 1-4 have been considered but are moot in view of the new ground(s) of rejection.

7. Applicant's arguments filed 12/15/2003 have been fully considered but they are not persuasive.

In response to applicant's arguments, the recitation atomic layer deposition apparatus has not been given patentable weight because the recitation occurs in the preamble (pg 6). A preamble is generally not accorded any patentable weight where it merely recites the purpose of a process or the intended use of a structure, and where the body of the claim does not depend on

the preamble for completeness but, instead, the process steps or structural limitations are able to stand alone. See *In re Hirao*, 535 F.2d 67, 190 USPQ 15 (CCPA 1976) and *Kropa v. Robie*, 187 F.2d 150, 152, 88 USPQ 478, 481 (CCPA 1951). The combination of Sivaramakrishnan et al, Nishizawa et al, Powell et al and Tsuchimoto or the combination of Sivaramakrishnan et al, Nishizawa et al, Tsuchimoto and Schmitt et al teaches all of the structural limitations of the instantly claimed invention, as discussed previously, therefore the structure taught by the combination of Sivaramakrishnan et al, Nishizawa et al, Powell et al and Tsuchimoto or the combination of Sivaramakrishnan et al, Nishizawa et al, Tsuchimoto and Schmitt et al would be capable of performing the intended use of the structure, namely as an atomic layer deposition apparatus.

Applicants' argument that the prior art does not teach all the features of the instantly claimed invention is noted but is not found persuasive. Applicants allege that the combination of Sivaramakrishnan et al, Nishizawa et al, Powell et al and Tsuchimoto or the combination of Sivaramakrishnan et al, Nishizawa et al, Tsuchimoto and Schmitt et al does not teach the plasma generators are **for** alternatively activating the material gases supplied through the gas supply pipes in a manner enabling operation without requiring temperature stabilization times by minimizing absorption of a reactive gas and a temperature sensitivity of a chemical reaction when materials comprising plural different components are to be deposited as the film. The Examiner has admitted this deficiency in the rejection. However, the Examiner maintains this feature is merely an intended use of the instantly claimed structure and the structure taught by the combination of Sivaramakrishnan et al, Nishizawa et al, Powell et al and Tsuchimoto or the combination of Sivaramakrishnan et al, Nishizawa et al, Tsuchimoto and Schmitt et al would be

capable of performing the intended use claimed by applicants. A recitation of the intended use of the claimed invention must result in a structural difference between the claimed invention and the prior art in order to patentably distinguish the claimed invention from the prior art. If the prior art structure is capable of performing the intended use, then it meets the claim. See *In re Casey*, 152 USPQ 235 (CCPA 1967) and *In re Otto*, 136 USPQ 458, 459 (CCPA 1963). It is also noted that ALD process are known to be performed in chemical vapor deposition tools, as evidenced by Lopatin et al (US 6,538,327) column 4, lines 40-50.

In response to applicant's argument that Nishizawa et al teaches injection of etchant gas, rather than reaction gas (pg 6), a recitation of the intended use of the claimed invention must result in a structural difference between the claimed invention and the prior art in order to patentably distinguish the claimed invention from the prior art. If the prior art structure is capable of performing the intended use, then it meets the claim. In a claim drawn to a process of making, the intended use must result in a manipulative difference as compared to the prior art. See *In re Casey*, 152 USPQ 235 (CCPA 1967) and *In re Otto*, 136 USPQ 458, 459 (CCPA 1963). Nishizawa et al teaches pipes, which are capable of injection of gases. Nishizawa et al teaches using one of the pipes for injection of an etchant, as suggested by applicants. However, the pipes taught by Nishizawa et al would be capable of injection of other gases and would be capable of performing the intended use of supplying reaction gases claimed by applicants.

In response to applicant's argument that Powell and Schmidt teaches injection of gases simultaneously rather than alternatively, a recitation of the intended use of the claimed invention must result in a structural difference between the claimed invention and the prior art in order to patentably distinguish the claimed invention from the prior art. If the prior art structure is

capable of performing the intended use, then it meets the claim. In a claim drawn to a process of making, the intended use must result in a manipulative difference as compared to the prior art. See *In re Casey*, 152 USPQ 235 (CCPA 1967) and *In re Otto*, 136 USPQ 458, 459 (CCPA 1963). The combination of Sivaramakrishnan et al, Nishizawa et al, Powell et al and Tsuchimoto or the combination of Sivaramakrishnan et al, Nishizawa et al, Tsuchimoto and Schmitt et al does teach simultaneous operation, as suggested by applicants. However, the structure taught by the combination of Sivaramakrishnan et al, Nishizawa et al, Powell et al and Tsuchimoto or the combination of Sivaramakrishnan et al, Nishizawa et al, Tsuchimoto and Schmitt et al would be capable of alternatively supplying gases because the combination of Sivaramakrishnan et al, Nishizawa et al, Powell et al and Tsuchimoto or the combination of Sivaramakrishnan et al, Nishizawa et al, Tsuchimoto and Schmitt et al teaches on off valves **6** and 7, which would be capable of the claimed intended use of supplying gases alternatively.

Conclusion

8. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Solomon et al (US 6,179,913) teaches a compound nozzle **33**, where an outlet **34b** is completely encircled by an outlet **32b** and the outlet **34b** is coaxial with outlet **32b** (col 4, ln 55-67 and Figs 2-4).

Lopatin et al (US 6,538,327) teaches an ALD process is performed using a chemical vapor deposition tool (col 4, ln 40-50).

9. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

10. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Matthew J Song whose telephone number is 571-272-1468. The examiner can normally be reached on M-F 9:00-5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nadine Norton can be reached on 571-272-1465. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Matthew J Song
Examiner
Art Unit 1765

MJS

NORTON
SUPERVISORY PATENT EXAMINER